

NOTES ON PHILIPPINE TERMITES, I

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The social insects known as termites, "white ants" or, in Philippine dialects, as *anay*, constitute a distinct order, the Isoptera. They are most nearly related to the Orthoptera and Neuroptera and, within the former order, to the Blattidæ, or cockroaches. They are, therefore, among the more primitive of insects, as regards structure and life history, which but makes the more impressive the high development of social instincts and habits and the striking polymorphism and division of labor which characterize the group. In structure and development they are far removed from the true ants, of the order Hymenoptera, and as has been often pointed out the only reasons for the name "white ants" are that they form large colonies with a highly developed division of labor and specialization of castes, build mounds or nests, and display a complex social system—all suggestive of conditions among the true ants.

The termites present splendid opportunities for the study of social habits and instincts and are at the same time of very great economic importance because of the enormous damage caused by their attacks on wooden structures and even living trees and shrubs. Hence any work on termites—systematic, morphological, ecological, or faunistic—is of practical value and may have a direct, present-day bearing on human welfare.

The literature dealing with termites is very extensive. The works of outstanding importance are those of Smeathman (1781), Hagen (1855–1860, who gives a complete summary of all earlier work), Grassi and Sandias (1893), Froggatt (1895–1897), Sjöstedt (1896–1914), Wasmann (1896 to the present time), Haviland (1898), Silvestri (1901 to the present time), Banks (1901 to the present time but particularly his "A Revision of the Nearctic Termites," 1920), Heath (1903 and 1907), Desneux (1904–1907), Holmgren (1906 to the present time), Escherich (1908 and 1912), Bugnion (1910–1915), Oshima (1910 to the present time), Andrews (1911), Snyder (1912 to the present time), Fuller (1912 and 1915), Hill (1915

to the present time), Hozawa (1915), Thompson (1916 to the present time), and others.

In spite of the many and extensive studies which have been made on termites, the ecological field is barely touched, and much remains to be done along systematic and economic lines. This is particularly true in the Tropics, where termite life reaches its climax, and most strikingly is it the case in the Philippine Archipelago, where systematic study has been only begun and little has been done along biological lines.

Led but recently into this fascinating field of study through an investigation of the protozoan parasites which are found in the intestines of the more primitive genera, I regret that my study of the termites was not begun many years ago. They furnish an ideal combination of theoretical and practical interest. The strangeness of form and the variety in shape of the different species, particularly of their soldiers, the high development of caste and division of labor, the fascinatingly interesting glimpses of a complex social development based on instinct, the ever-present problem of lessening or preventing their inroads on wooden structures—all combine to make this one of the most compelling and profitable fields of insect study. This is particularly true in a region where the termites are all around one, where there is hardly a house but shows signs of their ravages, where any dead limb or stump, or piece of waste wood, or the very chair on which you sit may harbor a colony, perhaps of a species as yet unknown to science, at least interesting in all the details of its complex life and as yet practically unstudied.

The Philippine termite fauna is apparently very rich. This might be expected when we consider the large number of islands, the great variety of habitat, and the luxuriance of plant life.

In this set of Notes on Philippine Termites, I plan to work over the systematic field until all but the rarest species are thoroughly known. Ultimately, I hope to monograph our Philippine termites with full descriptions, illustrations, and keys. Such economic and biologic data as accumulate from time to time will also be published, and when the systematic work is on a firm basis I hope to publish the results of more extensive economic and ecologic investigations.

CLASSIFICATION

The classification of termites is in a superficially unsatisfactory condition due to various causes. This condition has resulted mainly from failure to follow more or less widely

accepted rules of nomenclature, from failure to investigate generic types and designate them in the case of new genera, and from lack of clear definitions of generic and subgeneric groups, as well as from the inherent difficulties involved in systematic work in a group where polymorphism occurs and where it is often necessary to establish species and even genera without all the variants, the adult or the soldiers being unknown in many cases. Conservatism on the part of the older workers in the group and a dislike to make radical changes in well-established generic names is easily understood and to be expected, and it may be said before going any further that the system of classification due mainly to Holmgren, and in part to Silvestri, Wasmann, Froggatt, and others seems to present a very natural arrangement of the families and genera of termites. Banks,¹ however, in a recent monograph on Nearctic termites, not only has presented a new grouping of the genera but has made radical changes in generic names based on a study of type species. *Odontotermes* and *Microcerotermes*, for example, become synonyms and are replaced, respectively, by the older generic names *Termes* and *Eutermes*, at present applied to other and very large groups.

Such a condition places the beginner in the field in a most unfortunate position. He recognizes on the one hand, the splendid results of the older workers and sympathizes with their very natural sentiments with regard to names of long standing, which are recognized by practically all termitologists; but, on the other hand, he sees the need and the great importance of definite rules of nomenclature. Therefore, he stands, as it were, at the parting of the ways, hesitant as to the path he shall follow, lacking that confidence which can only come from a mature knowledge of the field and, hence, feeling a natural timidity at the idea of attempting to change long-established usage but, on the other hand, lacking that sentiment for the older names so natural to one to whom the work of years has endeared them and, especially if a younger man, he finds himself facing a most unpleasant dilemma.

If further researches show that Banks's contentions as to generic types are justified, it seems inevitable that the changes in generic names which he proposes must in part at least be adopted. Not being able to verify them myself, however, I shall

¹ Banks, Nathan, A Revision of the Nearctic Termites, Bull. U. S. Nat. Mus. 108 (1920).

retain the older names until a more mature knowledge of the group or further researches on the part of other workers or consensus of opinion makes necessary the radical changes in generic names involved.

Several of the larger genera, *Calotermes*, *Termes*, and *Eutermes*, contain quite distinct subgroups which it has been customary to consider as subgenera, the result being cumbersome tripartite names. The recent tendency has been toward considering these groups as genera whenever possible, a tendency which makes for simplicity and greater ease in classification.

With regard to families, the divisions of Holmgren seem to fulfill the requirements of a natural classification but the names Protermitidæ, Mesotermitidæ, and Metatermitidæ, not being based on type genera, must ultimately be replaced, preferably by Kalatermitidæ, Rhinotermitidæ, and Termitidæ, respectively.

With regard to the use of adult characters or those of soldiers for classification, I agree with Banks to the extent that I believe the divisions between larger groups and the ultimate classification of the group as a whole should be based on the characters of the adult as being phylogenetically the typical form; but for practical purposes and for preliminary classification the characters of the soldiers are available and will be used by me, as indeed they are by him and all other systematic workers on termites. Were we to wait for the collection of the adults of the different species, we should be halted indefinitely in our study of Philippine forms, for the imago is unknown for nearly two-thirds of the species so far reported from the Philippines. Indeed, after some little collecting experience I am compelled to wonder at the almost marvelous success of Haviland in obtaining queens and winged adults under somewhat similar conditions.

Hagen,² in his very complete survey of the literature dealing with termites, mentions three very early descriptions of Philippine termites. I give them here because of their local historical interest rather than for their scientific value.

The first of these, and probably the first mention in literature of Philippine termites, is by Nieremberg³ in 1635 and consists of a description of an "ant" from the Philippines under the name of *sulum*, which Hagen believes to be a termite.

The second of these early notices of Philippine termites is

² Hagen, *Linnea Ent.* 9-12 (1855-1860).

³ Nieremberg, *Histor. nat.* 1635, fol. lib. 13, cap. 13, p. 28." Hagen, *Linnea Ent.* 10 (1855) 19.

found among descriptions of animals, etc., in a History of Mexico by Hernandez, published in 1651.⁴ Here again the animal concerned is given the name *sulum* and is believed by Hagen to be the same termite.

The third and last of these early descriptions of Philippine animals believed by Hagen to refer to termites is found in an article, describing various Philippine animals, written by the Jesuit Father Camel (Camelli) and communicated by Petiver⁵ in 1709 to the Royal Philosophical Society of London.

According to Hagen, who quotes extensively, Camelli gives descriptions of fourteen species of "ants" from the Philippines, of which Hagen believes that five possibly apply to termites. The first of these he believes to be the same as the *sulum* of Nieremberg and of Hernandez and gives it the name *bondoc* which means in Philippine dialects "mountain" or "hill" and is never used to mean ant or termite. It seems probable that Father Camelli misunderstood his informants and substituted the name of the habitat for that of the animal. The description he gives seems to suggest a termite, particularly with regard to the size of the queen or, as he puts it, the king and the form of the nest. The animals, however, are spoken of as being black. Hagen believed this to be a description of *Termes carbonarius*, which is darker than most termites. Unfortunately for this surmise, *T. carbonarius* has not been recorded from the Philippines. While this does not by any means prove that the species does not exist here, it suggests that *T. carbonarius* is not among our common forms, and consequently it is rather improbable that specimens of this species were found among the first known termites.

But for their habitat ("cushions and pillows!"), which has never been noted for a termite, the second of these descriptions might well apply to one of the smaller wood-attacking species, such as those of the genus *Coptotermes* or *Microcerotermes*, since he describes the insects as small, white, and about the size of a louse. To these he gives the name *cuyutil*, which I have not been able to place in any Philippine dialect, and speaks of the insects as living in cushions and pillows where they make their nests of clay. The word *cuitib* is used in Tagalog for

⁴"Hernandez, animalium etc. Mexican. historia Romae. fol. 1651, im angehängten liber unicus etc., p. 76." Hagen, Linnea Ent. 10 (1855) 29.

⁵"De variis animalibus Philippinensibus ex Mss. Geo. Jos. Camelli communicavit Petiver. Philos. Transact. 1709, vol. 26, No. 318." Hagen, Linnea Ent. 12 (1858) 247.

a very small red ant and it is barely possible that this has been distorted into cuyutil.

The next two descriptions seem to apply to some lac-forming insects rather than to termites, since they are called *lac-ha* and are spoken of as forming a gumlike mass; and, aside from their living in trees, there is nothing in the descriptions which would seem to place them as termites.

The last of the descriptions, and the only one which is undoubtedly that of a termite, refers to the terrible destructiveness of the insect to wooden structures, clothes, books, etc., and here for the first time we find recorded the name *anai* or *anay* almost universally applied to termites in Philippine dialects. It is, however, quite impossible to determine from the description which termite is here referred to, and one is led to believe that much of hearsay is mixed with a modicum of fact.

In the systematic portion of his monograph Hagen records only a single termite species, *Termes dives* Hagen,⁶ from the Philippines. His species was based on adult material from the Philippines and Java and has been shown by Holmgren⁷ to belong to the genus *Odontotermes*, and the soldiers described by Hagen to belong to *Termes gilvus*. It has not as yet been identified with any of our known forms.

The soldiers, larvæ, etc., collected in the Philippines by Heer and placed by Hagen under *Termes* are placed by Holmgren⁷ under the common Malayan *Macrotermes* species, *Termes gilvus*. This would seem to be Oshima's *T. (M.) copelandi* and it seems probable that the latter name must be considered a synonym of the first. Further study of a wide range of material will be necessary to clear up this point.

The next species to be reported from the Philippines was *Termes distans* Haviland, reported by him in 1898⁸ from the Sulu Islands.

Since Haviland's paper the only systematic work on Philippine termites has been done by Oshima, who has published descriptions in four different papers.⁹

The only biological work on Philippine termites consists of a paper by Uichanco (1919)¹⁰ on the biology of the common mound-

⁶ Hagen, Linnea Ent. 12 (1858) 139-142.

⁷ Holmgren, Kungl. Sv. Vet. Akademiens Handlingar 50, 2 (1913) 131.

⁸ Haviland, Journ. Linn. Soc. London 26 (1898) 401, 402.

⁹ Oshima, Annot. Zool. Jap. 8 (1914) 553-585; Philip. Journ. Sci. § D 9 (1916) 351; 12 (1917) 217-225; 17 (1920) 489-512.

¹⁰ Uichanco, Philip. Journ. Sci. 15 (1919) 59-65.

building form, probably *Termes* (*Macrotermes*) *copelandi* Oshima or *philippinensis* Oshima, and a paper by Brown (1918)¹¹ on the fungi cultivated by the mound-building termites identified by Oshima¹² as *Termes* (*Macrotermes*) *philippinensis* Oshima.

To date there have been reported from the Philippine Islands thirty-three species of termites; thirty by Oshima and one each by Hagen, Haviland, and Holmgren. Oshima's first Philippine material was collected by Prof. C. F. Baker, dean of the College of Agriculture, University of the Philippines, at Los Baños, where the College is located. That for his last three papers was collected by Mr. R. C. McGregor, associate editor of the Philippine Journal of Science, at present acting director of the Bureau of Science. Mr. McGregor has shown the greatest interest in my work as also in the previous termite work. He has been an invaluable aid both by personal collecting and by helping me to make collections as well as by his unflagging interest and enthusiasm. I wish to take this opportunity of expressing my appreciation for what he has done and, I feel certain, will continue to do to aid in the study of our termite fauna.

A list of the species reported from the Philippines forms a part of this paper. I do not feel ready to give the species the names which recent changes in the knowledge of generic types and diagnoses and a fuller comparative knowledge of our termite fauna may well require. I have therefore given them the scientific names under which they were reported from the Islands. The names and date or dates in parentheses refer to the reporter and date when reported.

Following each species the following data are given: 1, original locality; 2, distribution within the Archipelago and collectors; 3, distribution outside the Archipelago; 4, habitat notes; 5, imago, whether known or unknown.

Mr. Baker's material and that of Mr. McGregor, with the exception of one collection from Panay, was all collected within a radius of 65 kilometers of Manila. Therefore, collections having been made in but two islands, and in very limited regions of each, the distribution data will have but little faunistic value. It is hoped, however, that our future collecting may be sufficiently thorough to allow for the ultimate drawing of conclu-

¹¹ Brown, Philip. Journ. Sci. § C 13 (1918) 223-231.

¹² Oshima, Philip. Journ. Sci. 17 (1920) 489-512.

sions as to species range, faunal affinities, migration routes, etc.; the present data are given here merely to form a starting point for future studies on distribution.

TERMITES REPORTED FROM THE PHILIPPINES

Calotermes (*Neotermes*) *malatensis* Oshima, 1917. (Oshima, 1917, 1920.)

Original locality: Manila.

Philippine distribution: Luzon, Manila (*McGregor*).

No foreign distribution known.

"From a decayed limb of a small tree (*Samanea saman* Merrill)."

Imago known.

Calotermes (*Neotermes*) *lagunaensis* Oshima, 1920.

Original and only known locality: Luzon, Laguna Province, Paete (*McGregor*).

Imago unknown.

Coptotermes *flavicephalus* Oshima, 1914. (Oshima, 1914, 1916.)

Original and only known locality: Luzon, Laguna Province, Los Baños (*Baker*).

Imago unknown.

Coptotermes *formosanus* Shiraki, 1909. (Oshima, 1920.)

Original locality: Formosa.

Philippine distribution: Manila (*McGregor*).

Foreign distribution: Formosa, China Coast, and Japan.

"Formosa's most destructive termite."

Imago known from Formosa and Japan but not from the Philippines.

Coptotermes *travians* (Haviland, 1898). (Oshima, 1920.)

Original localities: Singapore and Sarawak.

Philippine distribution: Luzon, Manila (*McGregor*); Panay, Antique Province, Culasi (*McGregor*).

Foreign distribution: Malay Peninsula and Borneo.

"Making covered tunnels on telephone posts." "Attacking house posts, floors, clothing, and papers."

Imago known but not from the Philippines.

Rhinotermes (*Schedorhinotermes*) *bidentatus* Oshima, 1920.

Original and only known locality: Panay, Antique Province, Culasi (*McGregor*).

"Living in a decaying log in the forest."

Imago unknown.

Rhinotermes (*Schedorhinotermes*) *longirostris* (Brauer, 1865). (Oshima, 1916.)

Original locality: Nicobar Islands.

Philippine distribution: Luzon, Laguna Province, Paete and Sarai near Paete (*McGregor*).

Foreign distribution: Celebes and Nicobar Islands.

"Found in tunnels in a much decayed log."

Imago unknown from the Philippines.

Rhinotermes (*Schedorhinotermes*) *tarakensis* Oshima, 1914. (Oshima, 1920.)

Original locality: Tarakan, Dutch Borneo.

Philippine distribution: Luzon, Laguna Province, near Paete (*McGregor*).

Foreign distribution: Borneo.

Living "under a hard, round, black nest."

Imago unknown.

Termitogetonella *tibiaoensis* Oshima, 1920.

Original and only known locality: Panay, Antique Province, Tibiao (*McGregor*).

"Living in an old log."

Imago known.

Termes (*Termes*) *copelandi* Oshima, 1914. (Oshima, 1914, 1916, 1920.)

Termes (*Macrotermes*) *copelandi* Oshima, 1920.

Original locality: Los Baños.

Philippine distribution: Luzon, Laguna Province, Los Baños (*Baker*); Manila (*McGregor*); Rizal Province (*McGregor*); Palawan (*Schultze*); Panay, Capiz Province, Ibaday (*McGregor*).

No foreign distribution known as such but if, as seems probable, this is *Termes gilvus*, it is widespread throughout the East Indies.

"Forms broad low clay mounds." "Makes earthen runways over trees and shrubs eating their bark." One of the commonest mound-building termites, if not the only common mound-building species.

Imago unreported as such.

Common throughout East Indies.

Termes *dives* Hagen, 1858.

Original locality: Manila (*Baron von Huegel*, *Heer*, *Chamisso*).

Philippine distribution not known.

Foreign distribution: Common throughout East Indies.

Imago known.

Termes gilvus Hagen, 1858. (Holmgren, 1913.)

Probably the same as *T. copelandi* Oshima.

Termes (*Macrotermes*) *luzonensis* Oshima, 1914. (Oshima, 1914, 1916, 1920.)

Original locality: Los Baños.

Philippine distribution: Luzon, Laguna Province (*Baker*); Rizal Province (*McGregor*).

No foreign distribution known.

"Builds large earth mounds and makes tunnels on *Artocarpus*." Probably a form of *T. copelandi* or *T. gilvus*.

Imago (queen) known but not described.

Termes (*Macrotermes*) *manilanus* Oshima, 1914. (Oshima, 1914, 1916, 1920.)

Original locality: Manila.

Philippine distribution: Luzon, Manila (*C. S. Banks*); Laguna Province (*McGregor*); Panay, Antique Province, Culasi (*McGregor*).

No foreign distribution known.

Known only from winged imago.

Termes (*Macrotermes*) *philippinensis* Oshima, 1914. (Oshima, 1914, 1916, 1917, 1920.)

Original locality: Los Baños, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*Baker*); Manila (*McGregor*); Bulacan Province (*McGregor*); Panay, Antique Province, Culasi (*McGregor*).

No foreign distribution known.

"Builds large earth mounds. Makes tunnels on *Artocarpus*."

Imago known.

Common throughout East Indies.

Odontotermes mediodentatus Oshima, 1920.

Original and only known locality: Paete, Laguna Province (*McGregor*).

Imago unknown.

Eutermes (*Hospitalitermes*) *hospitalis* (Haviland, 1898). (Oshima, 1920.)

Original locality: Sarawak, Borneo.

Philippine distribution: Luzon, Rizal Province, San Francisco del Monte (*McGregor*).

Foreign distribution: Malay Archipelago, Borneo.

"Day foragers."

Imago known from Borneo but not from the Philippines.

Eutermes (*Hospitalitermes*) *luzonensis* Oshima, 1917. (*E. [H.] hospitalis* of Oshima, 1916.) (Oshima, 1917, 1920.)

Original locality: Sarai, near Paete, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*); Rizal Province (*McGregor*).

No foreign distribution.

"Day foragers."

Imago not known.

Eutermes (*Hospitalitermes*) *saraiensis* Oshima, 1916.

Only known locality: Sarai, near Paete, Laguna Province (*McGregor*).

Imago unknown.

Eutermes (*Ceylonitermes*) *mcgregori* Oshima, 1916. (Oshima, 1916, 1920.)

Original locality: Sarai, near Paete, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*); Panay, Antique Province (*McGregor*).

No foreign distribution known.

"In decayed wood."

Imago known.

Eutermes (*Eutermes*) *balintauacensis* Oshima, 1917. (Oshima, 1917, 1920.)

Original locality: Balintauac, near Manila, Rizal Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*); Rizal Province (*McGregor*).

No foreign distribution known.

"Covered tunnels on *Caesalpinia sappan* Linn."

Imago unknown.

Eutermes (Eutermes) castaneus Oshima, 1920.

Original locality: Sarai, near Paete, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*); Panay, Antique Province (*McGregor*).

No foreign distribution known.

Imago unknown.

Eutermes (Eutermes) gracilis Oshima, 1916. (Oshima, 1916, 1920.)

Original locality: Sarai, near Paete, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*).

No foreign distribution known.

Imago unknown.

Eutermes (Eutermes) las-piñasensis Oshima, 1920.

Original locality: Sarai, near Paete, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*McGregor*); Manila (*McGregor*); Rizal Province (*McGregor*); Bulacan Province (*McGregor*).

No foreign distribution known.

"Makes wide covered tunnels over *Pithecolobium* and *Barringtonia* which it attacks."

Imago unknown.

Eutermes (Eutermes) manilensis Oshima, 1916.

Original and only known locality: Manila (*C. S. Banks*).

Imago unknown.

Eutermes minutus Oshima. (Oshima, 1917.)

Reported from Las Piñas, Rizal Province (*McGregor*).

"Inside an old log."

Eutermes (Grallatotermes) luzonicus Oshima, 1914. (Oshima, 1914, 1916, 1920.)

Original locality: Los Baños, Laguna Province.

Philippine distribution: Luzon, Laguna Province (*Baker*); Manila (*McGregor*); Rizal Province (*McGregor*); Panay, Antique Province (*McGregor*); Capiz Province (*McGregor*).

No foreign distribution known.

"Attacks *Pithecolobium*, *Spondias*, bamboo, cocos, and wooden parts of houses." Our commonest *Eutermes* species.

Imago unknown.

Eutermes (Grallatotermes) panayensis Oshima, 1920.

Original and only known locality: Culasi, Antique Province, Panay (*McGregor*).

"From tunnels on large tree."

Imago unknown.

Eutermes (Trinervitermes) menadoensis Oshima, 1914. (Oshima, 1920.)

Original locality: Menado, Celebes.

Philippine distribution: Luzon, Rizal Province (*McGregor*); Laguna Province (*McGregor*).

Foreign distribution: Borneo and Celebes.

"Attacks *Ficus* and *Barringtonia*, making covered tunnels from nests on ground."

Imago unknown.

Eutermes (*Rotunditermes*) *culasiensis* Oshima, 1920.

Original and only known locality: Culasi, Antique Province, Panay (*McGregor*).

"In bark of decayed log."

Imago unknown.

Microcerotermes *los-bañosensis* Oshima, 1914. (Oshima, 1914, 1916, 1917, 1920.)

Original locality: Los Baños, Laguna Province (*Baker*).

Philippine distribution: Luzon, Laguna Province (*Baker*, *McGregor*); Manila (*McGregor*); Bulacan Province (*McGregor*); Panay, Antique Province and Batbatan Island (*McGregor*); Romblon (*McGregor*).

No outside distribution known.

"One of our commonest Philippine termites. Makes hard nests at base of bamboo, cocos, *Pithecolobium*, etc., and builds tunnels over them. Occasionally attacks houses and furniture."

Imago known.

Termes *distans* Haviland, 1898.

Original localities: Sulu Islands and Celebes.

Philippine distribution: Sulu Islands (*Haviland*).

Foreign distribution: Celebes.

Imago known.

Capritermes *paetensis* Oshima, 1920.

Original and only known locality: Paete, Laguna Province, Luzon (*McGregor*).

"In damp ground under vegetable waste."

Imago unknown.

These thirty-three species of termites, recorded from the Philippines, belong to nine genera. One genus, *Termitogetonella* Oshima, 1920, is known from the Philippines only.

No less than twenty-three of these thirty-three species were named from Philippine material and are known from that region only. Which of these are truly endemic cannot be determined until we have a much more thorough knowledge of the species on the Asiatic mainland, and the East Indies. That some of them will later be found to be present in nearby regions seems most probable. That some few of them will be found to be synonymous with species already described from Borneo, Singapore, Java, Japan, Formosa, etc., seems probable, particularly in the case of species belonging to the genera *Coptotermes*, *Macrotermes*, and *Eutermes*. Such cases will probably be comparatively rare, however, due to the fact that Professor Oshima had the peculiar advantage of studying his first Phil-

ippine material in connection with numerous species from the Malay Archipelago and adjacent regions. Oshima is also an authority on Formosan and Japanese termites and hence we should expect little overlapping of specific diagnoses with that region.

Judging from the fact that most termite species have a comparatively limited range, we should expect collections made from the central area of the Archipelago to yield a high percentage of endemic species. That not only the percentage of new species but the actual number of such species is high indicates that the Islands have a remarkably rich termite fauna.

The species are distributed as follows:

Luzon	27
Laguna Province	21
Manila and Rizal Province ^a	16
Bulacan Province	3
Panay	12
Antique Province	11
Capiz Province	2
Batbatan Island	1
Romblon	1
Palawan	1
Sulu Islands	1

^a The city of Manila belongs naturally with Rizal Province and will be so considered in questions of distribution.

The numbers for the different provinces and islands are not, of course, an index of the number of termite species to be found in them, but are merely an indication of the amount of collecting done. The figures are given in order to form a starting point for further investigation. Nineteen species are so far known from Luzon only, four from Panay only, and one from the Sulu Islands only. Eight species are reported from both Panay and Luzon; one from Panay, Romblon, and Luzon (*Microcerotermes losbañosensis* Oshima); and one from Palawan, Panay, and Luzon (*Termes* (*Macrotermes*) *copelandi* Oshima). These would seem to be our commonest and most-widespread species, but further study may show them to be polyspecific groups. The former is a nest-building form, and the latter builds large, low, clay or earthen mounds. It is possible that the former will be found to consist of a number of closely related species, as Haviland suggests of the corresponding Borneo and Malay Archipelago forms. Furthermore, the *Macrotermes* groups will require very extensive and intensive study before we can diagnose the species with certainty.

Of the thirty-three species of Philippine termites nine, and possibly one more,¹³ have been reported from other regions. Of these but one, *Coptotermes formosanus* Oshima, is found in Formosa and Japan, and the other eight are from the East Indies and the Malay Archipelago. Six of these eight are found in Borneo and two in Celebes, showing the expected relationship of our fauna to that of those regions. Of these *Coptotermes travians* Haviland seems to have the greatest range, being reported from Ceylon and intermediate regions. Further study, however, may show our species to be distinct from that of Haviland.

The data as to interrelations of termite faunæ are so fragmentary at present as to make it impossible to speak with any surety, but we may confidently expect that further study will show our fauna to have a close relation, through Palawan and the Sulu Islands, with that of Borneo and the Malay Peninsula, and through the Babuyanes and Batanes with that of Formosa and Japan.

It will be seen that twenty-seven of the known species have been recorded from Luzon and that twenty of these were described by Oshima as new to science. The Luzon collections have been made in a very limited area within 65 kilometers of Manila, mainly in Laguna and Rizal Provinces (with the latter of which Manila should be included from the point of view of distribution), with some few from near the Rizal-Bulacan boundary. It might be expected that collections from so limited a region yielding so many new species would have exhausted the readily available new forms. On the contrary, however, collections made by Mr. McGregor and myself on four half-day trips over the same ground—that is, to Alabang, Antipolo, Balintauac, and Montalban, respectively—all type localities for many of Oshima's species—together with a few collections in and about Manila made by Mr. McGregor, myself, and some of my students show about thirty different species. Seventeen or more of these appear to be new to the Philippines and most, if not all, of these new to science. There is every reason to believe, therefore, that complete collections from the many islands of the Archipelago ranging from the Batanes in the north, which should give us an interesting intergradation with the Formosan fauna, to the Sulu Islands in the south, whose termite fauna should furnish interesting relationships with that of Borneo, Celebes, and the Malay

¹³ *Eutermes minutus* Oshima, Philip. Journ. Sci. § D 12 (1917) 225. I have been unable to locate the description of this species, which is mentioned in the above paper without references or subgenus.

Peninsula, should show the Philippine Archipelago to have one of the richest termite faunas of the world and one of the most interesting for the study of variation, distribution, and faunistic relations and their bearing on the problem of evolution.

Of the thirty-three species of termites known from the Islands the adult is known for only twelve. Mr. McGregor, who collected much of Oshima's material and who is at present aiding me in my collections, concurs with me in a feeling of admiration for the success of Haviland in procuring the adult forms of so many of the species which he describes. While we hope ultimately to achieve a similar success, it is rather discouraging to seek through a nest, piece by piece, only to find thousands of eggs and immature forms but no sign of adults. This has happened so many times with the forms which have nasute soldiers that we have come to the conclusion that the queen and king must be located in some subterranean chamber from which the eggs are transported to more exposed regions to pass through their development stages.

This is but one example of the many gaps to be filled before our knowledge of Philippine termites is at all complete. Aside from its systematic interest, every one of the many Philippine species presents a fascinating problem, almost untouched, in ecology, social habits, and morphology, and several of them present economic problems of great importance. Any extensive work along such lines must, however, await a fuller knowledge of the systematic position of our termite species.

The next of this series of notes will present descriptions of several new species belonging to genera or subgenera not heretofore reported from the Philippines.